ΕΝΩΣΗ ΕΠΙΣΤΗΜΟΝΙΚΟΥ ΠΡΟΣΩΠΙΚΟΥ ΝΟΣΟΚΟΜΕΙΟΥ "Ο ΕΥΑΓΓΕΛΙΣΜΟΣ" (Ε.Ε.Π.Ν.Ε.)

ΚΛΙΝΙΚΟ ΦΡΟΝΤΙΣΤΗΡΙΟ
HANDS-ON COURSE
«Αναζωογόνηση σε μη τραυματία»

Αλγόριθμος ΚΑΡΠΑ-ALS

Παντελής Γουνόπουλος
Β' καρδιολογική κλινική

RESUSCITATION 161 (2021) 115 –151

Available online at www.sciencedirect.com

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

EUROPEAN RESUSCITATION COUNCIL

European Resuscitation Council Guidelines 2021: Adult advanced life support

There are no major changes in the 2020 Adult ALS Guidelines

Adult advanced life support (ALS)

includes

- the advanced interventions that follow basic life support (BLS) and
- use of an automated external defibrillator (AED)

Basic life support continues during and overlaps with ALS interventions

EUROPEAN RESUSCITATION COUNCIL
GUIDELINES 2021

- ALS section includes the prevention and treatment of both

✓ inhospital cardiac arrest (IHCA) and

✓ out-of-hospital cardiac arrest (OHCA)

- the ALS algorithm
- manual defibrillation
- airway management during cardiopulmonary resuscitation (CPR)
- drugs and their delivery during CPR
- the treatment of peri-arrest arrhythmias.

EUROPEAN RESUSCITATION COUNCIL
GUIDELINES 2021

Prevention of cardiac arrest

- Patients with both in- and out- of hospital cardiac arrest have premonitory signs, and that many of these arrests may be preventable (ie. family members of young victims of SCD) .
- Chest pain, syncope (especially during exercise, while sitting or supine) and palpitations warrant further evaluation.
- In clinical settings use an early warning score to identify and treat patients at increased risc of cardiac arrest.

EUROPEAN RESUSCITATION COUNCIL

National Early Warning Score (NEWS) 2

Physiological parameter	Score						
	3	2	1	0	1	2	3
Respiration rate (per minute)	≤8		9–11	12–20		21–24	≥25
SpO_2 Scale 1 (%)	≤91	92–93	94–95	≥96			
SpO_2 Scale 2 (%)	≤83	84–85	86–87	88–92 ≥93 on air	93–94 on oxygen	95–96 on oxygen	≥97 on oxygen
Air or oxygen?		Oxygen		Air			
Systolic blood pressure (mmHg)	≤90	91–100	101–110	111–219			≥220
Pulse (per minute)	≤40		41–50	51–90	91–110	111–130	≥131
Consciousness				Alert			CVPU
Temperature (°C)	≤35.0		35.1–36.0	36.1–38.0	38.1–39.0	≥39.1	

Royal College of Physicians

In-hospital cardiac arrest

1.5/1000 patients

- Emergency care treatment and CPR decisions
- Physiological deterioration
- Staff education
- Monitoring
- Recognition
- The call for help: structured communication tools such as **SBAR** (situation-background-assessment-recommendation)
- Response : rapid response systems

EUROPEAN RESUSCITATION COUNCIL

Treatment of in-hospital cardiac arrest

- **Hospital systems** should aim to recognise cardiac arrest, start CPR immediately, and defibrillate rapidly (< 3 min)

- **All hospital staff** should be able to

✓ rapidly recognize cardiac arrest

✓ call for help

✓ start CPR and

✓ defibrillate (attach an AED – automated extrernal defibrillatior- and follow the AED prompts, or use a manual defibrillator).

- Hospitals should have a **resuscitation team** that immediately responds to IHCAs.

EUROPEAN RESUSCITATION COUNCIL
GUIDELINES 2021

- **Resuscitation team members** should have the key skills and knowledge to

✓ manage a cardiac arrest including manual defibrillation

✓ advanced airway management

✓ intravenous access, intra-osseous access

✓ identification and treatment of reversible causes.

- **Start ALS as early as possible.**

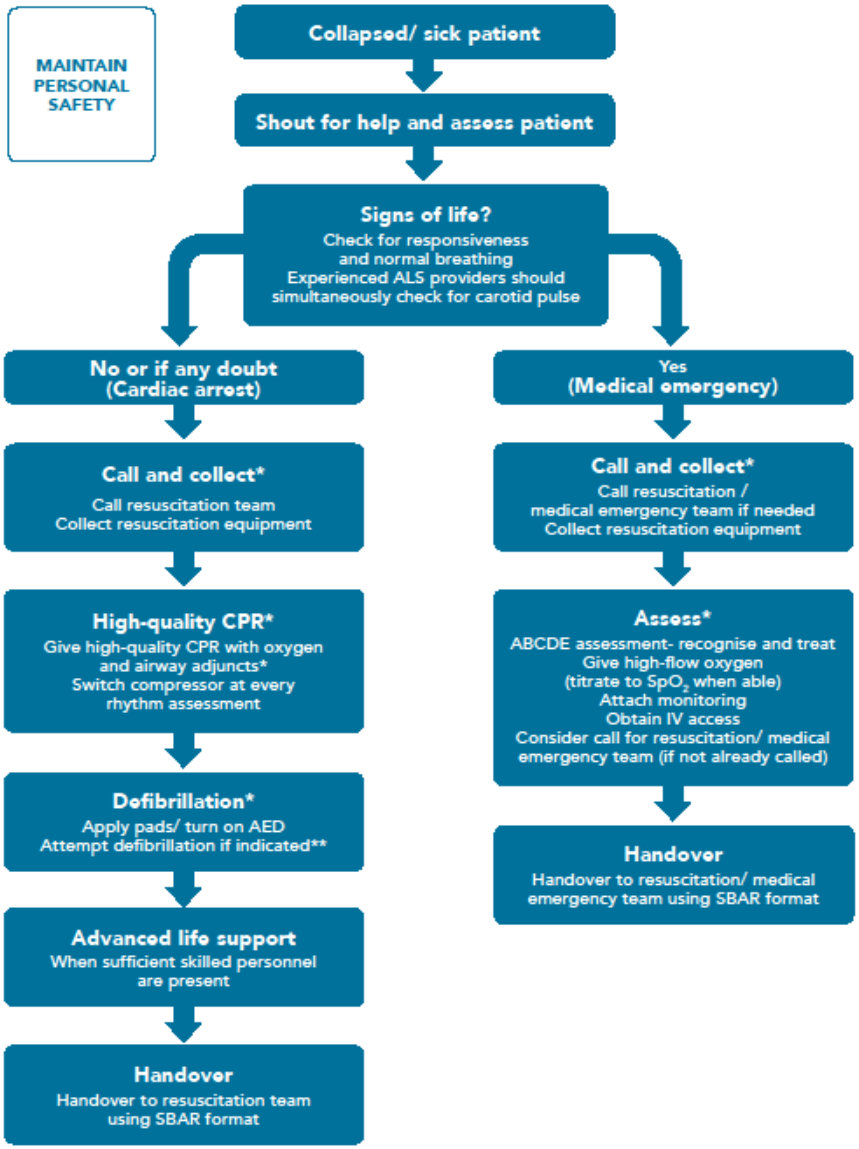
- Emergency medical systems (EMS) should consider implementing criteria for the with holding and termination of resuscitation (TOR) taking in to consideration specific local legal, organizational and cultural context (Ethics)

- Emergency medical systems (EMS) should monitor staff exposure to resuscitation and low exposure should be addressed to increase EMS team experience in resuscitation.

EUROPEAN RESUSCITATION COUNCIL
GUIDELINES 2021

IN-HOSPITAL RESUSCITATION

EUROPEAN RESUSCITATION COUNCIL GUIDELINES 2021

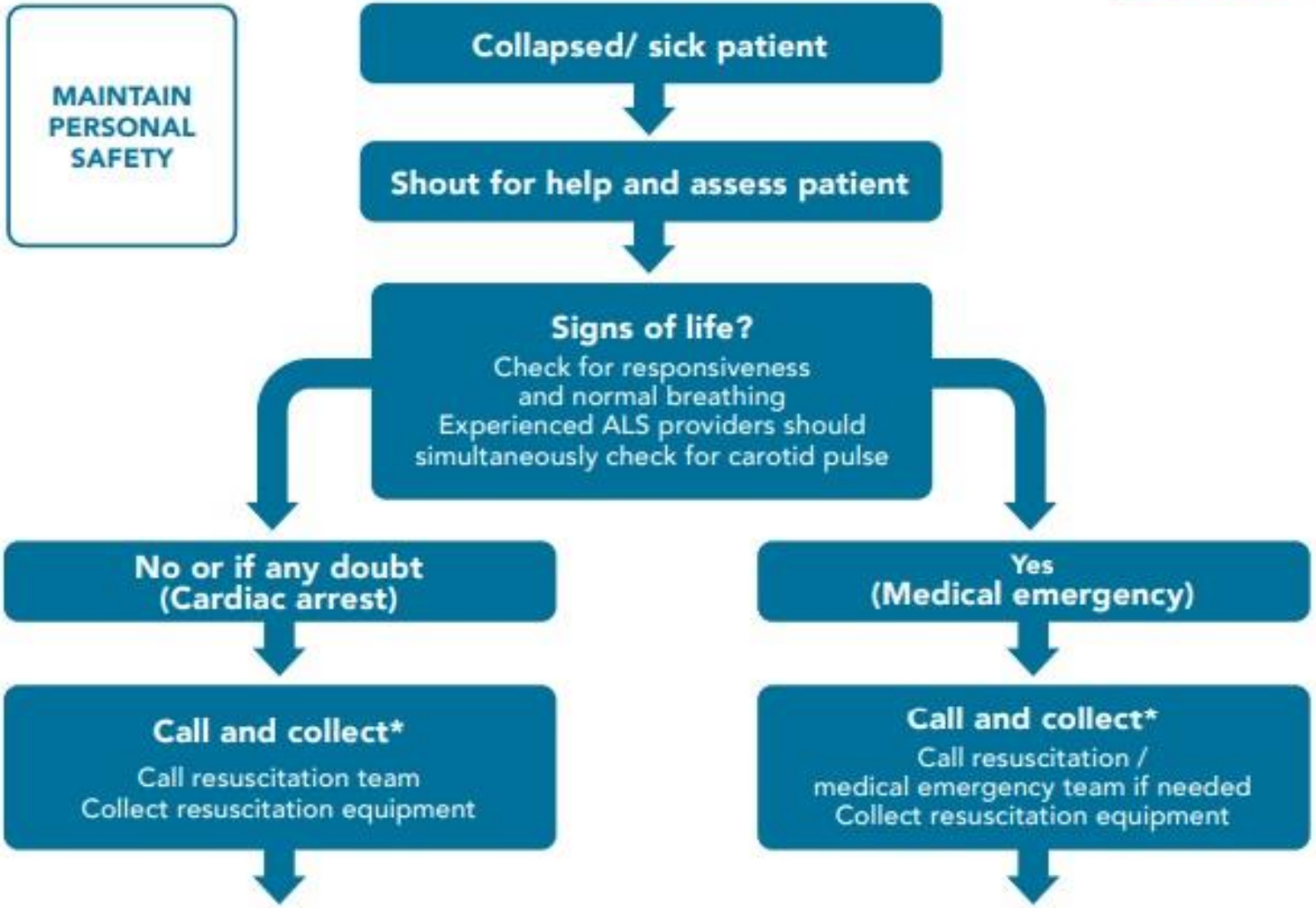


** Undertake actions concurrently if sufficient staff available*
***Use a manual defibrillator if trained and device available*

EUROPEAN RESUSCITATION COUNCIL GUIDELINES 2021

IN-HOSPITAL RESUSCITATION

EUROPEAN RESUSCITATION COUNCIL
GUIDELINES 2021



High-quality CPR*

Give high-quality CPR with oxygen and airway adjuncts*
Switch compressor at every rhythm assessment

Defibrillation*

Apply pads/ turn on AED
Attempt defibrillation if indicated**

Advanced life support

When sufficient skilled personnel are present

Handover

Handover to resuscitation team using SBAR format

Assess*

ABCDE assessment- recognise and treat
Give high-flow oxygen (titrate to SpO_2 when able)
Attach monitoring
Obtain IV access
Consider call for resuscitation/ medical emergency team (if not already called)

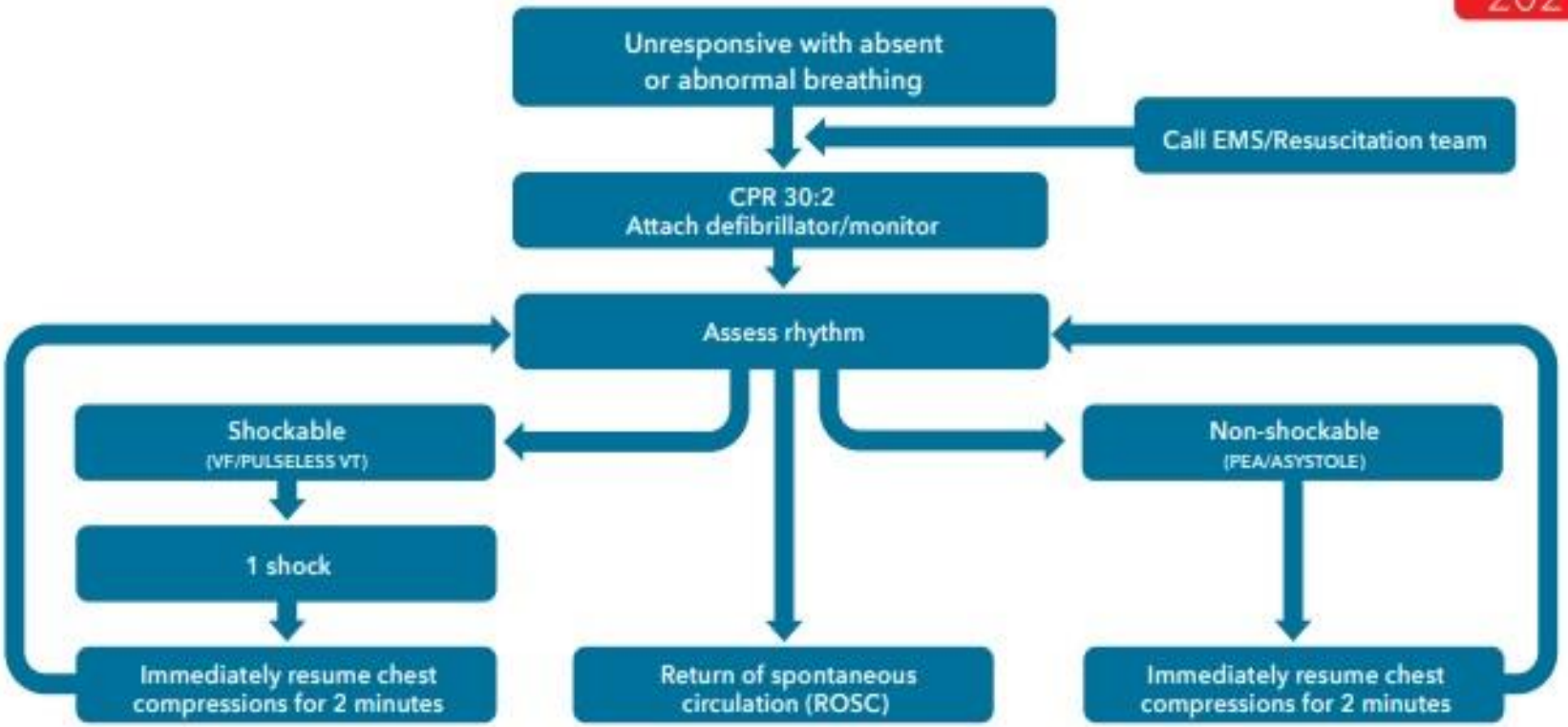
Handover

Handover to resuscitation/ medical emergency team using SBAR format

** Undertake actions concurrently if sufficient staff available*
***Use a manual defibrillator if trained and device available*

ADVANCED LIFE SUPPORT

EUROPEAN RESUSCITATION COUNCIL
GUIDELINES 2021



Give high-quality chest compressions and

- Give oxygen
- Use waveform capnography
- Continuous compressions if advanced airway
- Minimise interruptions to compressions
- Intravenous or intraosseous access
- Give adrenaline every 3-5 min
- Give amiodarone after 3 shocks
- Identify and treat reversible causes

Identify and treat reversible causes

- Hypoxia
- Hypovolaemia
- Hypo-/hyperkalemia/metabolic
- Hypo-/hyperthermia
- Thrombosis - coronary or pulmonary
- Tension pneumothorax
- Tamponade- cardiac
- Toxins

Consider ultrasound imaging to identify reversible causes

Consider

- Coronary angiography/percutaneous coronary intervention
- Mechanical chest compressions to facilitate transfer/treatment
- Extracorporeal CPR

After ROSC

- Use an ABCDE approach
- Aim for SpO_2 of 94-98% and normal $PaCO_2$
- 12 Lead ECG
- Identify and treat cause
- Targeted temperature management

High quality CPR and early defibrillation

- High quality chest compressions : hard and fast 5-6cm 120/m
- Shock as early as possible
- ALS: 5 sec pause for rapid assessment – manual defibrillator

Manual defibrillation

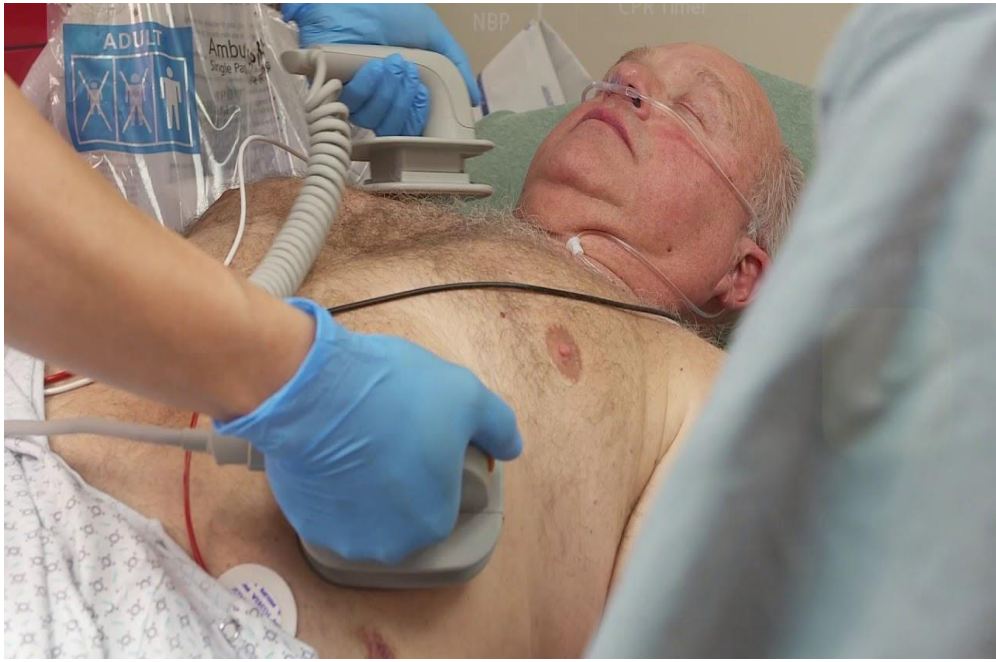
- **Antero-lateral pad position** is the position of choice for initial pad placement. Ensure that the apical (lateral) pad is positioned correctly (mid-axillary line, level with theV6 pad position)i.e. below the armpit.

- In patients with an implantable device, place the pad > 8 cm away from the device, or use an alternative pad position
- Alternate pad position when the patient is in the prone position (bi-axillary) or
- In a refractory shockable rhythm (anterior-posterior).

EUROPEAN RESUSCITATION COUNCIL
GUIDELINES 2021

Manual defibrillation

- **Give a shock as early as possible**
- **Deliver shocks with minimal interruption to chest compression of less than 5 sec and then immediately resume chest compressions.**



- **Signs** of return of spontaneous circulation (ROSC) such as

✓ waking

✓ purposeful movement

✓ arterial waveform

✓ a sharp rise in end-tidal carbon dioxide (ETCO2)

consider stopping chest compressions for rhythm analysis, and if appropriate a pulse check.

EUROPEAN RESUSCITATION COUNCIL
GUIDELINES 2021

Give high-quality chest compressions and

- Give oxygen
- Use waveform capnography
- Continuous compressions if advanced airway
- Minimise interruptions to compressions
- Intravenous or intraosseous access
- Give adrenaline every 3-5 min
- Give amiodarone after 3 shocks
- Identify and treat reversible causes

EUROPEAN RESUSCITATION COUNCIL

AIRWAY AND VENTILATION DURING CPR

- Use a stepwise approach to airway managenent according to the skills of the rescuer:

✓ Bag mask

✓ Supraglottic airway

✓ Tracheal tube if >95% success within 2 attempts, in 5sec

- Give the maximum inspired oxygen, 10/min, no interruptions

EUROPEAN RESUSCITATION COUNCIL

Drugs and fluids

- Vascular access: Intravenous (IV) access and intraosseous (IO)
- Vasopressor drugs: **Adrenaline**.
- Antiarrhythmic drugs: Amiodarone , Lidocaine
- Thrombolytic drugs : when pulmonary embolus is the suspected or confirmed cause of cardiac arrest (consider CPR for 60-90 min after administration of thrombolytic drugs).

EUROPEAN RESUSCITATION COUNCIL

Adrenaline

- Give adrenaline 1 mg IV (IO) as soon as possible for adult patients in cardiac arrest with a non-shockable rhythm.
- Give adrenaline 1 mg IV (IO) after the 3rd shock for adult patients in cardiac arrest with a shockable rhythm.
- Repeat adrenaline 1 mg IV (IO) every 3-5 min whilst ALS continues (2 cycles of CPR).

➢ Improves survivors / neurological outcome?

EUROPEAN RESUSCITATION COUNCIL

Identify and treat reversible causes : 4H-4T

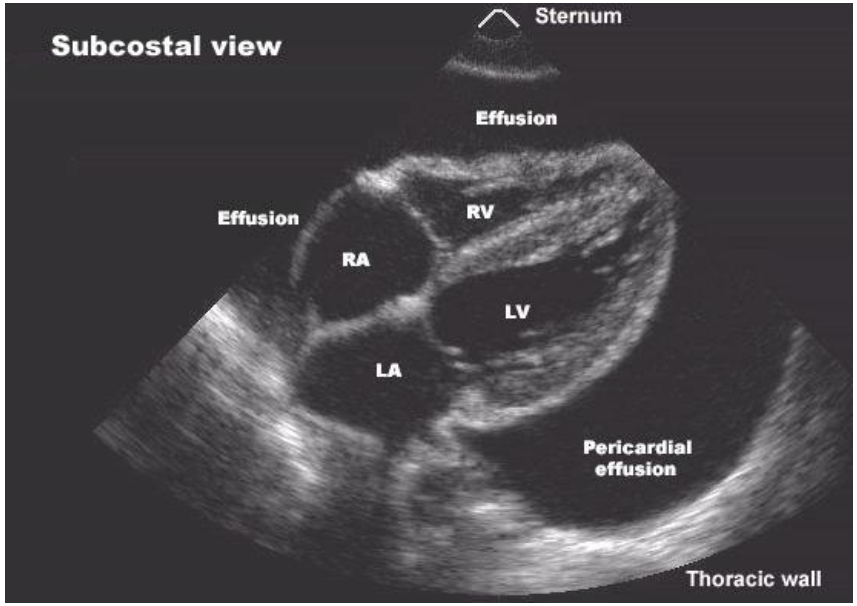
- Hypoxia
- Hypovolaemia
- Hypo-/hyperkalemia/metabolic
- Hypo-/hyperthermia
- Thrombosis – coronary or pulmonary
- Tension pneumothorax
- Tamponade- cardiac
- Toxins

Consider ultrasound imaging to identify reversible causes

EUROPEAN RESUSCITATION COUNCIL

Ultrasound imaging during ALS

- Only skilled operators should use intra-arrest point-of-care ultrasound (POCUS).
- Do not cause additional or prolonged interruptions in chest compressions.
- Use to diagnose treatable causes of cardiac arrest such as **cardiac tamponade and pneumothorax.**



- Right ventricular dilation in isolation during cardiac arrest should not be used to diagnose massive pulmonary embolism.

- Do not use for assessing contractility of the myocardium as a sole indicator for terminating CPR (rythme, duration arrest).

EUROPEAN RESUSCITATION COUNCIL
GUIDELINES 2021

Consider

- Coronary angiography/percutaneous coronary intervention
- Mechanical chest compressions to facilitate transfer/treatment
- Extracorporeal CPR

EUROPEAN RESUSCITATION COUNCIL
GUIDELINES 2021

Consider Extracorporeal CPR

- **Rescue therapy for selected patients with cardiac arrest**
- When conventional ALS measures are failing
- To facilitate specific interventions:

✓ coronary angiography and percutaneous coronary intervention (PCI)

✓ pulmonary thrombectomy for massive pulmonary embolism,

✓ rewarming after hypothermic cardiac arrest.

➢ Specialized teams in settings in which it can be implemented.

EUROPEAN RESUSCITATION COUNCIL
GUIDELINES 2021

Post resuscitation care

After ROSC

- Use an ABCDE approach
- Aim for SpO_2 of 94-98% and normal $PaCO_2$
- 12 Lead ECG
- Identify and treat cause
- Targeted temperature management

EUROPEAN RESUSCITATION COUNCIL
GUIDELINES 2021

	Initial assessment (look, listen, feel)	Measure	Action	Consider (after initial assessment)	
A Airway	**Is the airway patent - can the patient talk?** Snoring, stridor, obstruction (e.g. foreign body, vomit, blood, edema) Cervical spine		**Non-patent airway:** - Head tilt, chin lift, jaw thrust - Suction - Naso/oropharyngeal airway **O^2 (15 L/min)**		Assess, Treat as you go and Re-assess
B Breathing	Cyanosis, use of accessory muscles, breathing depth and rhythm, tracheal position, symmetrical chest expansion Breath sounds and auscultation Chest percussion	Respiratory rate SpO^2	Positioning of patient Bag/pocket mask ventilation Decompression of pneumothorax Inhalations	ABG Chest X-ray	
C Circulation	Bleeding Skin: - Color (pale, red, mottled) - Cool/warm/dry/sweaty Auscultation	Capillary refill time Pulse Blood pressure ECG	Stop bleeding IV/IO access Fluids/blood	12-lead ECG Blood tests Urinary catheter ECHO/FAST/FATE	
D Disability	AVPU Pupils (reaction, size, equal) Neck stiffness	GCS Blood glucose	Recovery position	Lumbar puncture Focused neurologic assessment Rectal examination (sphincter tonus)	
E Exposure	**Head-to-toe assessment:** - Trauma, fractures, wounds, lesions - Bleeding - Infection, petechiae, rash	Temperature	Prevent hypo-/hyperthermia Stabilize fracture	Blood cultures Culture from wound Antibiotics	

Post resuscitation care

After ROSC

- Use an ABCDE approach
- Aim for SpO_2 of 94-98% and normal $PaCO_2$
- 12 Lead ECG
- Identify and treat cause
- Targeted temperature management

EUROPEAN RESUSCITATION COUNCIL
GUIDELINES 2021

Peri-arrest arrhythmias

The assessment and treatment of all arrhythmias addresses

- ✓ the condition of the patient (stable versus unstable) and
- ✓ the nature of the arrhythmia.

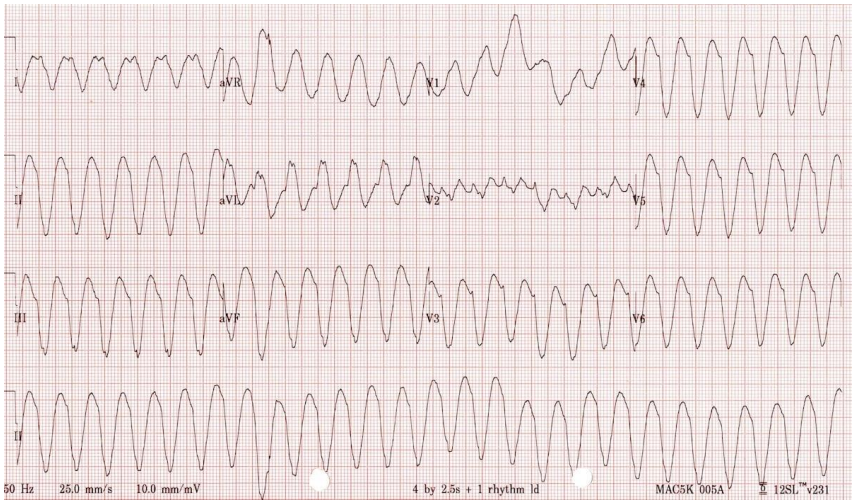
<u>Life-threatening features in an unstable patient include:</u>

- **Shock**
- **Syncope**
- **Severe heart failure**
- **Myocardial ischaemia**

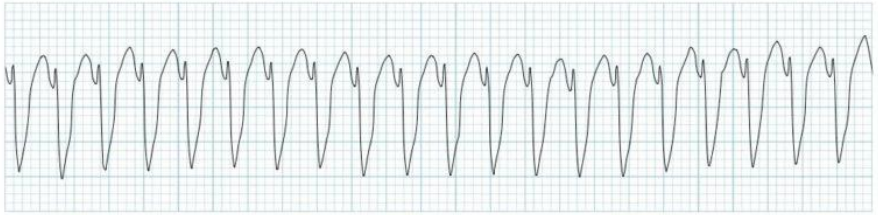
EUROPEAN RESUSCITATION COUNCIL
GUIDELINES 2021

Tachycardias

- **Electrical cardioversion** is the preferred treatment for tachyarrhythmia in the unstable patient displaying potentially lifethreatening adverse signs.



- **Conscious patients** require anaesthesia or sedation, before attempting synchronised cardioversion.



EUROPEAN RESUSCITATION COUNCIL GUIDELINES 2021

TACHYCARDIA

EUROPEAN RESUSCITATION COUNCIL
GUIDELINES 2021

ASSESS with ABCDE approach
- Give oxygen if SpO_2 < 94% and obtain IV access
- Monitor ECG, BP, SpO_2. Record 12 lead ECG
- Identify and treat reversible causes (e.g. electrolyte abnormalities, hypovolaemia causing sinus tachycardia)

Life-threatening features?
1. Shock
2. Syncope
3. Myocardial ischaemia
4. Severe heart failure

YES

Synchronised shock up to 3 attempts
- Sedation, anaesthesia if conscious

If unsuccessful:
- Amiodarone 300 mg IV over 10-20 min, or procainamide 10-15 mg/kg IV over 20 min;
- Repeat synchronised shock

UNSTABLE

NO

STABLE
SEEK EXPERT HELP

Is QRS narrow (<0.12 s)?

Broad QRS
Is QRS regular?

Irregular

Possibilities include:
- Atrial fibrillation with bundle branch block – treat as for irregular narrow complex
- Polymorphic VT (e.g. torsades de pointes) – give magnesium 2 g over 10 min

Regular

If VT (or uncertain rhythm):
- Procainamide 10-15 mg/kg IV over 20 min
  or
- Amiodarine 300 mg IV over 10-60 min

If previous certain diagnosis of SVT with bundle branch block/ aberrant conduction:
- Treat as for regular narrow complex tachycardia

Narrow QRS
Is QRS regular?

Regular

Vagal manoeuvres

If ineffective:
Adenosine (if no pre-excitation)
- 6 mg rapid IV bolus;
- If unsuccessful give 12 mg
- If unsuccessful give IV 18 mg

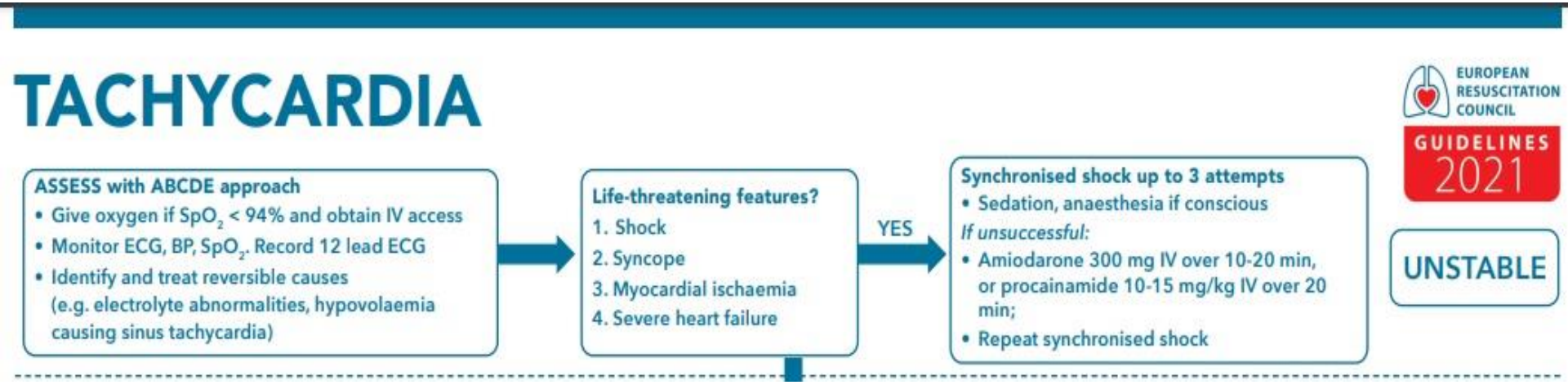
If ineffective:
- Verapamil or beta-blocker

Irregular

Probable atrial fibrillation:
- Control rate with beta-blocker or diltiazem
- Consider digoxin or amiodarone if evidence of heart failure
- Anticoagulate if duration > 48h

If ineffective:
- Synchronised DC shock up to 3 attempts
- Sedation, anaesthesia if conscious

Tachycardias - ALS focus



Bradycardia - ALS focus

- If bradycardia is accompanied by adverse signs, give atropine 500mg IV (IO) and, if necessary, repeat every 35 min to a total of 3 mg.

- If treatment with atropine is ineffective, consider second line drugs. These include isoprenaline (5mg min1 starting dose), and adrenaline (210mg / min).

- For bradycardia caused by inferior myocardial infarction, cardiac transplant or spinal cord injury, consider giving aminophylline (100 - 200 mg slow intravenous injection).

  Do not give atropine to patients with cardiac transplants it can cause a high-degree AV block or even sinus arrest use aminophylline.

- Consider giving glucagon if beta-blockers or calcium channel blockers are a potential cause of the bradycardia.

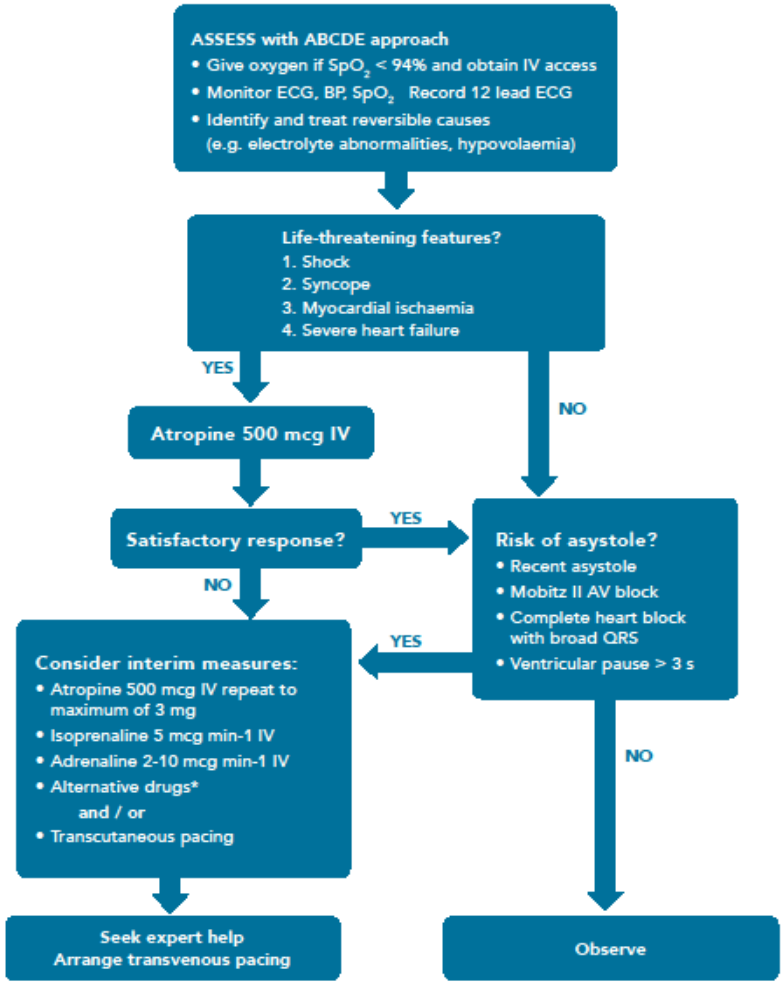
- Consider pacing in patients who are unstable, with symptomatic bradycardia refractory to drug therapies.

  If transthoracic pacing is ineffective, consider transvenous pacing.

EUROPEAN RESUSCITATION COUNCIL

BRADYCARDIA

EUROPEAN RESUSCITATION COUNCIL GUIDELINES 2021



* Alternatives include:

- *Aminophylline*
- *Dopamine*
- *Glucagon (if bradycardia is caused by beta-blocker or calcium channel blocker)*
- *Glycopyrrolate (may be used instead of atropine)*

ALS 2021

5 TOP MESSAGES

EUROPEAN RESUSCITATION COUNCIL

1. High-quality chest compression with minimal interruption, early defibrillation, and treatment of reversible causes remain the priority

2. Premonitory signs and symptoms often occur before cardiac arrest in- or out-of-hospital – cardiac arrest is preventable in many patients

3. Use a basic or advanced airway technique – only rescuers with a high success rate should use tracheal intubation

4. Use adrenaline early for non-shockable cardiac arrest

5. In select patients, if feasible, consider extracorporeal CPR (eCPR) as a rescue therapy when conventional ALS is failing

EUROPEAN RESUSCITATION COUNCIL

GUIDELINES 2021

Ευχαριστώ